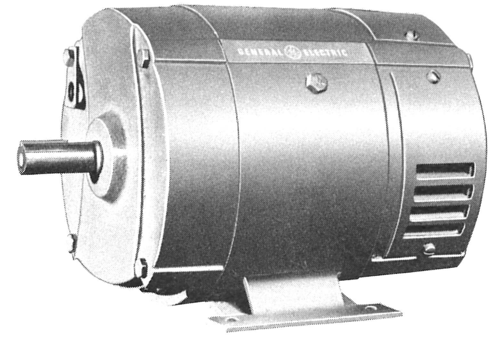
INSTRUCTIONS

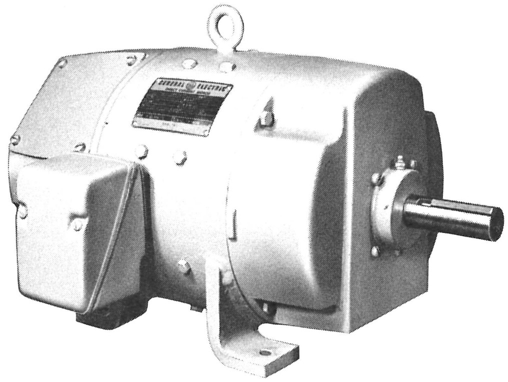
GEH-2304G

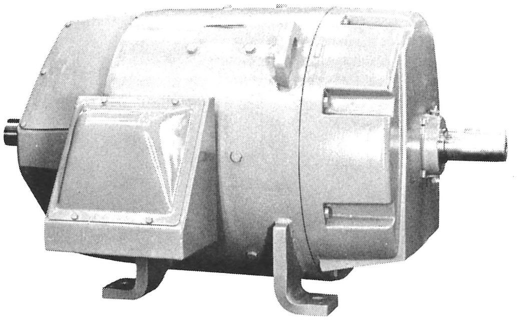
DIRECT CURRENT MOTORS AND GENERATORS

TYPES CD

FRAMES 180-680







GENERAL ELECTRIC

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DIRECT CURRENT MOTORS AND GENERATORS

TYPES CD

FRAMES 180-680

INTRODUCTION

This instruction book covers the 180-680 line of d-c motors and generators.

> **WARNING:** HIGH VOLTAGE AND ROTATING PARTS CAN CAUSE SERIOUS OR FATAL INJURY. THE USE OF ELECTRIC MACHINERY, LIKE ALL OTHER UTILIZATION OF CONCENTRATED POWER AND ROTATING EQUIPMENT, CAN BE HAZARDOUS. INSTALLATION, OPERATION, AND MAINTENANCE OF ELECTRIC MACHINERY SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. FAMILIARIZATION WITH NEMA SAFETY STANDARD FOR CONSTRUCTION AND GUIDE FOR SELECTION, INSTALLATION AND USE OF INTEGRAL HP MOTORS AND GENERATORS, NATIONAL ELECTRICAL CODE AND SOUND LOCAL PRACTICES IS RECOMMENDED.

These instructions do not purport to cover all details or variations in equipment nor to provide every possible contingency or hazard to be met in connection with installation, operation and maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchasers purposes, the matter should be referred to the General Electric Company.

RECEIVING

The equipment should be placed under adequate cover immediately upon receipt as packing coverings are NOT suitable for out-of-doors or unprotected storage.

Each shipment should be carefully examined upon arrival. Any damage should be reported promptly to the carrier and to the nearest office of the General Electric Company.

STORAGE

If a machine, or any part of a machine, is not to be installed immediately, it must be stored in a clean, dry place and protected from variations in temperature, high humidity, and dust. If possible, sudden changes in temperature and humidity should be avoided. If the temperature of the storage room varies to such an extent that the windings and coils are exposed to sweating or freezing conditions, the machine must be protected by a safe, reliable heating system which will keep the temperature of the machine slightly above that of the storage room. Brushes should not be allowed to remain in contact with the commutator during prolonged storage, otherwise corrosion may occur and later result in flat spots on the commutator.

If the machine has been exposed to low temperatures for an extended period of time, it should not be unpacked until it has reached room temperature, to avoid "sweating". The presence of moisture on the internal machine parts can cause electrical failure of insulated windings and/or mechanical failure of highly stressed armature glass banding.

All exposed machined-steel parts are slushed with a rust preventive before shipment. These surfaces should be examined carefully for signs of rust and moisture, and reslushed if necessary. Once started, rust will continue if the surface is reslushed without first removing all rust and moisture. Rust may be removed by careful use of fine abrasive paper. Slushing compound can be removed by use of a suitable solvent such as mineral spirits.

> **WARNING:** MINERAL SPIRITS ARE FLAMMABLE AND MODERATELY TOXIC. THE USUAL PRECAUTIONS FOR HANDLING CHEMICALS OF THIS TYPE SHOULD BE OBSERVED. THESE INCLUDE:
>
> 1. AVOID EXCESSIVE CONTACT WITH SKIN.
> 2. USE IN WELL-VENTILATED AREAS.
> 3. TAKE NECESSARY PRECAUTIONS TO PREVENT FIRE OR EXPLOSION HAZARDS.

Shaft journals and shaft extensions are precision ground and should be checked by experienced personnel. Care must be taken when cleaning to avoid damaging such surfaces. Extreme care must be exercised to prevent these parts from rusting since it is difficult, and sometimes impossible, to remove rust from these surfaces without damaging or deforming the surface. If burrs or bumps result from careless handling, carefully remove them, using a fine file or scraper. Machines in storage should be inspected, have the insulation resistance checked at frequent and regular intervals, and a log kept of pertinent data.

> **CAUTION:** WHEN STORED, IT IS SUGGESTED THAT THE ARMATURE BE ROTATED EVERY THREE MONTHS TO PREVENT LOSS OF GREASE PROTECTION ON THE BEARINGS AND RACES. LOSS OF GREASE PROTECTION CAUSES RUST.

HANDLING

Complete motors or generators can be lifted by using hooks or slings in the lifting lugs or eyebolts on top of the frame. The eyebolts of machines so provided have shoulders to provide proper seating, tightness and thread engagement; substitute eyebolts should not be used. The lifting lugs or eyebolts are designed to safely carry the weight of the whole machine. Do not lift the machine with the shaft extensions.

CAUTION: MOTOR-GENERATOR SETS SHOULD NOT BE LIFTED BY USING THE LIFTING LUGS OF INDIVIDUAL MACHINES.

Lifting holes, to be used with spreader bars or hooks, are provided in each base. Care must be taken in handling to avoid twisting bases.

INSTALLATION

Installation should be in accordance with the National Electric Code and consistent with all local codes. Coupling, belt, and chain guards should be installed as needed to protect against accidental contact with moving parts. Machines accessible to the public should be further guarded by screening, guard rails, etc. to prevent the public from coming in contact with the equipment. Fully guarded covers are available as factory accessory.

LOCATION

Motors and generators should be installed where they will be readily accessible for inspection and maintenance. Clean, dry, room air must be available for proper ventilation of machines which are not equipped for operation with filters, unit coolers or for separate ventilation from a source of clean air. It is important for all machines that the external openings for ventilation are not obstructed in any manner that might limit the free passage of air.

MOUNTING

Motors and generators should be mounted on rigid and solid foundations. Level the base (or the machine). Hold-down bolts should be inspected regularly and kept tight. The feet of the machine may be doweled to the foundation plates or base when alignment procedures are completed. Sliding bases, when used, should be securely anchored to the foundation.

ALIGNMENT

CAUTION: BE SURE TO ALIGN, OR CHECK ALIGNMENT, CAREFULLY ON EITHER MOTORS OR MOTOR-GENERATOR SETS. MISALIGNMENT CAN CAUSE EXCESSIVE VIBRATION AND DAMAGING FORCES ON SHAFTS AND BEARINGS. TIME TAKEN TO ASSURE GOOD ALIGNMENT WILL BE RETURNED IN REDUCED DOWNTIME.

COUPLED DRIVE

When a motor and a driven unit together have four or more bearings, flexible couplings may be used to facilitate alignment. Three-bearing construction requires a rigid coupling. Careful alignment of machines when using either solid (rigid) or flexible coupling is essential to prevent excessive vibration, short bearing and coupling life, or shaft failures.

V-BELT DRIVE

The driving and driven shafts should be located so that they are parallel and the sheaves aligned. If properly aligned, there is a minimum wear on the belts and no excessive thrust on the machine bearings. The sheave should be mounted as close as possible to the machine bearing.

The standard long shaft extension is designed for belted loads.

The following table can be used to select the MINIMUM allowable sheave diameter from the standpoint of bearing life and shaft stress. A larger sheave will further reduce the shaft stress and bearing loading. This table is based upon the belts being tightened to a maximum total pull of 1.5 times that required to transmit the load used in the sheave diameter calculation; the centerline of the belts should not extend beyond the end of the shaft.

TABLE I MINIMUM SHEAVE DIAMETER (INCHES)

CONT. HP†	2500	1750	1150	850
1	1–1/2*	1–1/2*	1–1/2*	1–1/2*
1–1/2	1–1/2*	1–1/2*	1–1/2*	2
2	1–1/2*	1–1/2*	2–1/2	3
3	1–1/2*	2–1/2	3	3
5	2–1/2	3–1/2	3–3/4	4
7–1/2	3	3–3/4	4–1/2	-
10	3–1/2	4	6	-
15	4–1/4	6	-	-
20	5–1/2	-	-	-

* Limited by shaft diameter.

† Short time rated motors will require larger pitch diameters.

For horsepower and speed ratings not appearing in Table I, General Electric's recommendation should be obtained and followed concerning the minimum sheave pitch diameter which can be used for the particular machine.

The belt manufacturer should be consulted for the maximum speed ratio and belt speed for the particular application. The maximum belt speed is usually 6000 feet per minute.

Belt-driven machines may be equipped with sliding bases. The adjusting screw on the sliding base should be located nearest the sheave and on the opposite side of the motor from the belts.

Belt idlers reduce the life of the belts and should not be used if any other method is available. The belts should never be forced over the sheaves. When the drive is started and operating at full speed and full load, the takeup should be adjusted until only a slight bow appears in the slack side. If slippage occurs after the belt tension has been correctly adjusted, the belts and pulleys have not been chosen properly for the job. Over-tightening to avoid slippage may result in early failures of belts, shafts and bearings.

CHAIN DRIVE

The driving and driven shafts should be located so that they are parallel and the sprockets aligned. The sprocket should be mounted as close as possible to the machine bearing. It is desirable that the machine be mounted on a sliding base so that excessive slack may be taken up to compensate for wear.

For the best mechanical arrangement, the upper side of the chain should be the slack side. However, on long drives or small sprocket drives, the lower side may be the slack side to prevent chain interference.

The limiting amount of elongation before the chain must be replaced is dependent upon design of the drive. The chain manufacturer should be consulted. The chain manufacturer should, also, be consulted concerning the maximum sprocket diameter, and the best means of lubricating the chain.

GEAR DRIVE

Drives with gears mounted directly on the machine shaft are sometimes used on this class of machines. All such applications should be referred to the General Electric Company.

THRUST LOADS

Due to the mounting position or type of drive arrangement a thrust load may be applied to the motor shaft. The Kinamatic motor is designed to permit a limited amount of thrust load. This permissible load will vary by mounting position and direction of the load due to the weight of the armature. The permissible load is tabulated below in Table II by frame diameter and mounting position.

For vertical mounting the data is tabulated with a plus or minus constant. If the force of the load is acting up (against gravity), then the constant should be plus. If the load is acting down (with gravity), then the constant should be minus.

If the application requires greater thrust-load capacity than determined above, modifications are available to provide significantly increased axial-load capacity. Refer the application to the factory in full detail.

MOTOR-GENERATOR SETS

G-E motor-generator sets are properly aligned before shipment. Check the alignment before operating a set to be sure that shipping, handling, and installation have not misaligned the units.

Two types of motor-generator set bases are used. One is called "non-self-supporting" and, as the name implies, is not as rigid as the self-supporting base. The non-self-supporting base is designed to act only as a spacer between the foundation and the units of the motor-generator set, and must not be trusted to carry any weight unless well supported at all the mounting pads on its underside. This type of base should be securely bolted to the foundation and, if convenient, grouted in after alignment. Grouting tends to make the base more solid and less liable to later vibration troubles. Be careful not to distort the base during handling or the ability to properly align the motor-generator set will be destroyed.

The other types of base is called "self-supporting" and usually has three pads on its underside forming a three-point support. A self-supporting base is rigid enough so that it needs support only at the pads. The entire weight of the motor-generator set is supported on just these three points and the foundation must be designed to take these high loads.

Two kinds of couplings are used to connect units of motor-generator sets. Some motor-generator sets will be made up of two-bearing units coupled together with flexible couplings. Others will use single-bearing generators connected with rigid (solid) couplings. With each kind of coupling and each kind of base design a slightly different alignment procedure is required. See Alignment Procedure.

GROUTING

On concrete foundations a minimum of one inch should be allowed for grouting.

TABLE II THRUST CAPACITY IN POUNDS

	HORIZONTAL MOUNTING				VERTICAL MOUNTING			
RPM FRAME	2500	1750	1150	850	2500	1750	1150	850
CD180	80	90	107	116	85±17	95±17	112±17	122±17
CD210	85	95	112	122	93±36	104±36	123±36	134±36
CD250	116	130	153	167	129±55	144±55	170±55	185±55
CD280	240	270	318	346	263±93	295±93	345±93	380±93
CD320	365	410	480	525	400±140	445±140	525±140	570±140
CD360	425	475	560	610	470±200	525±200	620±200	675±200
CD400	550	620	730	790	615±280	690±280	810±280	890±280
CD440	690	770	910	990	760±330	850±330	1000±390	1090±390
CD500	750	840	990	1060	860±500	960±500	1130±500	1230±500
CD580	615	690	810	890	710±828	800±828	940±828	1030±828
CD680	850	950	1120	1220	980±1128	1100±1128	1290±1128	1410±1128

A rich, non-shrink grout should be used. High-grade grout mixtures are available commercially. If the grout is to be prepared at the site, a cement-sand ratio of 1:2 is recommended. No more than enough water should be used to give a stiff mixture. The clean but rough surface of the foundations should be wet and the grout rammed or puddled under the base.

ALIGNMENT PROCEDURE

FLEXIBLE COUPLINGS, NON-SELF-SUPPORTING BASES

Before grouting the base, the alignment should be checked as follows:

1. Slide the sleeve from the coupling so that the hub faces are exposed.

2. Check that the coupling hub spacing is in accordance with the outline dimensions with the units in the mechanical center of their end play.

3. Start with the coupling next to the largest unit (usually the motor) or near the middle of a long set. Check the radial alignment by using a straightedge across the hubs at vertical, horizontal and 45 degrees or by clamping a dial indicator to one hub and indicating the other hub on its outside diameter. Be sure that the dial-indicator supports do not bend or sag, since this will give inaccurate readings.

4. Insert feeler gage or use dial indicator at hub faces and rotate both units together 90, 180, 270 and 360-degrees, measuring the gap at each position. The reading should not vary more than 0.002 inch.

5. Correct any misalignment by shimming between the base and the foundation. If shimming between the base and foundation will not correct misalignment, the unit has moved during shipment and should be shifted on the base.

6. Repeat Steps 2, 3 and 4 on each coupling, working away from the motor or center unit.

7. Recheck the couplings on long sets after completing the above checks, because shimming when checking subsequent units may affect those already checked. After the set has been aligned within the specified limits, the coupling shells may be bolted together.

The generators may then be doweled if desired.

SOLID FLANGED COUPLINGS, NON-SELF-SUPPORTING BASES

Before grouting the base, the alignment should be checked as follows:

1. Loosen all coupling bolts enough to assure that the bolts are not holding the couplings together.

2. Start with the coupling next to the largest unit (usually the motor) or near the middle of a long set, tap the coupling flange with a rawhide or similar non-metallic mallet until the coupling halves separate 0.005 to 0.010 inch.

3. Measure the distance between the coupling faces at four points spaced 90-degrees apart around the coupling rim with feelers; measuring to the nearest 0.001 inch. The maximum variation between any two readings should be not more than 0.002 inch.

4. Rotate the coupling 90, 180, 270 and 360-degrees and take similar readings. The maximum variation should not exceed 0.002 inch.

5. Correct any misalignment by shimming between the base and the foundation. If shimming between the base and the foundation does not correct misalignment, the unit has moved during shipment and should be shifted on the base.

6. Repeat Steps 2, 3, 4 and 5 on each coupling working away from the motor or center unit.

7. Recheck the couplings on long sets after completing the above checks, because shimming on subsequent units may affect those already checked. After the set has been aligned within the specified limits, tighten the coupling bolts.

The generators may then be doweled if desired.

CAUTION: DO NOT DRAW THE TWO COUPLING HALVES TOGETHER UNLESS THE VARIATION IN MEASUREMENTS IS 0.002 INCH OR LESS. IF THERE IS A VARIATION GREATER THAN 0.002 INCH, EXCESSIVE VIBRATION AND POSSIBLE SHAFT FATIGUE CAN OCCUR.

FLEXIBLE COUPLINGS, SELF-SUPPORTING BASES

Before operating the machine, the base should be bolted down and the alignment checked as follows:

1. Remove all the coupling bolts and slide the shells back so that the hub faces are exposed.

2. Check the coupling hub spacing in accordance with the outline dimensions with the units in the mechanical center of their end play.

3. Start with the coupling next to the largest unit (usually the motor) or near the middle of a long set. Check the radial alignment by using a straightedge across the two hubs at vertical, horizontal and 45 degrees or by clamping a dial-indicator to one hub and indicating the other on its outside diameter. Be sure that the dial-indicator supports do not bend or sag since this will give inaccurate readings.

4. Insert feeler gage or use dial indicator at hub faces and rotate both units together 90, 180, 270 and 360-degrees

measuring the gap at each position. The readings should not vary by more than 0.002 inches.

5. Correct the vertical alignment by shimming under the units. Abuses in shipment and handling may distort the dowels on the base to the extent that redoweling may be necessary.

6. Repeat Steps 2, 3 and 4 on each coupling working out away from the motor or center unit.

7. Recheck the couplings on long sets after completing the above checks, because shimming when checking subsequent units may affect those already checked. After the set has been aligned within the specified limits, the coupling shells may be bolted together.

SOLID FLANGED COUPLINGS, SELF-SUPPORTING BASES

Before operating the machine, the base should be bolted down and the alignment checked as follows:

1. Loosen all coupling bolts enough to assure that the bolts are not holding the couplings together.

2. Start with the coupling next to the largest unit (usually the motor) or near the middle of a long set. Tap the coupling flange with a rawhide or similar non-metallic mallet until the coupling halves separate 0.005 to 0.010 inch.

3. Measure the distance between the coupling faces at four points spaced 90 degrees around the coupling rim with feelers; measuring to the nearest 0.001 inch. The maximum variation between any two readings should be not more than 0.002 inch.

4. Rotate the coupling 90, 180, 270 and 360 degrees and take similar readings. The maximum variation should not exceed 0.002 inch.

5. Correct the vertical alignment by shimming under the units. Maintain all internal clearances of the generator during any correction of alignment by keeping the clearance between the coupling flange outside diameter and bracket bore uniform. Abuses in shipment and handling may distort the dowels on the base to the extent that redoweling may be necessary.

6. Repeat steps 2, 3, 4, and 5 on each coupling, working out away from the motor or center unit.

7. Recheck the couplings on long sets after completing the above checks, because shimming on subsequent units may affect those already checked. After the set has been aligned within the specified limits, tighten the coupling bolts.

CAUTION: DO NOT DRAW THE TWO COUPLING HALVES TOGETHER UNLESS THE VARIATION IN MEASUREMENTS IS 0.002 INCH OR LESS. IF THERE IS A VARIATION GREATER THAN 0.002 INCH, EXCESSIVE VIBRATION AND POSSIBLE SHAFT FATIGUE CAN OCCUR.

OPERATION

WARNING: DISCONNECT POWER BEFORE TOUCHING ANY INTERNAL PART. HIGH VOLTAGE MAY BE PRESENT EVEN WHEN THE MACHINE IS NOT ROTATING. IF USED WITH A RECTIFIER POWER SUPPLY, DISCONNECT ALL AC LINE CONNECTIONS TO POWER SUPPLY. WITH OTHER POWER SUPPLIES, DISCONNECT ALL DC LINE AND FIELD CONNECTIONS. ALSO DISCONNECT POWER FROM AUXILIARY DEVICES.

WARNING: GROUND THE MACHINE PROPERLY TO AVOID SERIOUS INJURY TO PERSONNEL. GROUNDING SHOULD BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND CONSISTENT WITH SOUND LOCAL PRACTICES.

INSPECTION BEFORE STARTING

These inspection procedures should be followed before starting the machine for the first time, after an extended shutdown, or after a teardown for extensive maintenance or repair.

BEARINGS AND COUPLINGS

Machines with ball or roller bearings are greased at the factory and will need no attention until relubrication is necessary as suggested in the maintenance section.

Flexible couplings should be checked to see that they contain the proper amount of lubricant.

Make sure that all oil and grease plugs are tight.

COMMUTATOR AND BRUSHES

Brushes should be worn in to have at least 85 percent contact over the brush surface and continuous contact from heel to toe. The commutator surface and undercut mica should be clean and free from dirt, grease, paint spots, or brush dust.

Brushes should be free to move in the holders and all springs should be down and latched. Brush pigtail connections should be tight and the pigtails should not interfere with the action of the spring or brush and should not contact any object that does not operate a brush holder potential.

CONNECTIONS

Terminal connections should be checked against the connection diagram shipped with the machine. Bolted connections must be tight. All exposed connections in the conduit box must be insulated.

PROTECTIVE DEVICES

See that all protective devices (overspeed devices, bearing temperature relays, etc.) are connected and will function properly. Be sure all coupling guards, shaft protectors, grounding connectors and other safety devices are properly attached.

VENTILATION SYSTEM

See that blowers or central systems are ready to supply cooling air. Air filters should be in place. Blowers should be checked for correct rotation. See outline or rotation arrow.

GENERAL MECHANICAL INSPECTION

Check the inside of the machine for tools, metal chips or any other foreign material that may have accumulated during storage or installation. Make sure that all rotating parts have clearance from any stationary parts. Turn the machine over by hand, if possible, and check for scraping noises or any other sign of mechanical interference. Check the tightness of the bolts in the feet, couplings, bearing housings, and any other bolts that may have been disturbed.

INSPECTION AFTER STARTING

The following items should be checked after the machine is running:

BEARINGS

Ball-bearing or roller-bearing housing temperatures should be not more than 65°C (149°F). Check alignment and lubrication if temperature exceeds this limit. DO NOT OVER-GREASE.

NOISE AND VIBRATION

Check for unusual vibration or noises that might indicate rubbing or interference. New machines may smell warm or have the odor of varnish but should not smell scorched.

Vibrations of new machines at the bearing housings, as measured by a G.E. light beam vibration meter, should not exceed the values shown below.

RPM	MAXIMUM AMPLITUDE IN INCHES
3500 & above	.001
1700 - 3499	.0015
Less than 1700	.002

The most likely cause of vibration in new machines is misalignment due to improper installation, loose foot bolts, uneven shimming under feet or damage to machine during shipment or installation. Current ripple due to rectifier power supply may also be a source of unusual vibration.

INSPECTION AFTER SHORT TIME IN SERVICE

After a machine has been operating for a short time, an inspection should be made to ascertain that there have been no changes since installation. Check for increased vibration, signs of change in alignment or foundation settling, bolts that may have loosened, rubbing parts, loose connections, and worsened commutation, and take the proper steps to correct the trouble. Also, check condition of air filters on blower ventilated machines. The amount of dirt in the air varies widely between installations.

MAINTENANCE

WARNING: HIGH VOLTAGE. ELECTRIC SHOCK MAY CAUSE SERIOUS OR FATAL INJURY. DISCONNECT POWER BEFORE TOUCHING ANY INTERNAL PART. HIGH VOLTAGE MAY BE PRESENT EVEN WHEN THE MACHINE IS NOT ROTATING. IF USED WITH A RECTIFIER POWER SUPPLY, DISCONNECT ALL A-C LINE CONNECTIONS TO POWER SUPPLY. WITH OTHER POWER SUPPLIES, DISCONNECT ALL D-C LINE AND FIELD CONNECTIONS. ALSO, DISCONNECT POWER FROM AUXILIARY DEVICES.

WARNING: GROUND THE MACHINE PROPERLY TO AVOID SERIOUS INJURY TO PERSONNEL. GROUNDING SHOULD BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND CONSISTENT WITH SOUND LOCAL PRACTICES.

BEARINGS (FRAMES 215A – 685A)

Ball-bearing housings are packed with grease at the factory. Greasing is not required before the motor is put into service. Since the oil in the grease will ultimately become depleted, it is necessary to relubricate ball-bearing motors periodically depending on size and type of service. (See Table III below.)

For best lubrication results, regrease with G-E grease No. D6A2C5. Avoid mixing different kinds of grease. Lubricate motor at standstill. Be sure lubrication fittings are clean and free from dirt. Remove lower grease relief plug (relief pipe on fan-cooled motor). Free the relief hole from any hardened grease. Use a hand-operated grease gun only. Pump in grease until new grease appears at lower grease hole. (Insert pipe occasionally on fan-cooled motors to check for appearance of new grease.) After greasing, allow motor to run about ten minutes before replacing grease relief plug (or pipe) to permit excess grease to drain out.

BEARINGS (FRAMES 182AT – L186AT)

To regrease bearings, the end brackets should be removed. Make certain, however, that the commutator end bracket is marked so that when replacing the bracket the location of the brushes is maintained. Both the bearings and the bearing housing should be cleaned with a hot, thin oil. The housing and the bearings should be repacked one-third to one-half full with grease and the end brackets replaced.

Avoid over greasing. Too much grease in the housing is the most common cause of early bearing failure.

TABLE III RECOMMENDED REGREASING PERIODS

TYPE OF SERVICE	TYPICAL EXAMPLES
Easy	Motor operating infrequently (1 hr./day)
Standard	Machine tools, fans, pumps, textile machinery
Severe	Motors for continuous operations in key locations subject to severe vibration; steel mill service; coal and mining machinery.
Very Severe	Dirty and vibrating applications where end of shaft is hot; high ambient

	HORSEPOWER	
1/2 – 7 1/2	10 – 40	OVER 40
10 yr. (Easy)	7 yr.	5 yr.
7 yr. (Standard)	5 yr.	3 yr.
4 yr. (Severe)	2 yr.	1 yr.
9 mo. (Very Severe)	4 mo.	4 mo.

REPLACEMENT OF BEARINGS

After the bearing brackets have been removed, a bearing puller may be used to pull the bearings from the shaft. Protect the shaft center while using the puller. On frames CD580 through CD685 it will be necessary to remove the bearing retaining snap ring before pulling the commutator end bearing. Discard the old bearing. The new bearing and all mating parts should be kept extremely clean during reassembly.

To install a new bearing, heat the bearing to 116-127°C (240-260°F) in oil or in an oven, then slip or press the bearing on the shaft. The bearing should be mounted tightly against the shoulder on the shaft on the commutator end of all machines and on the drive end of all machines in frames 507 and smaller. The drive end bearing of CD580 through CD685 frame machines should be assembled with the outboard side of the bearing flush with the shoulder on the shaft. After the bearing has cooled, re-install the retaining ring where used. Fill the grease reservoir in the inner bearing cap or cartridge 1/3 to 1/2 full or grease, butter the bearings, and fill the grease reservoir in the bearing bracket 1/3 to 1/2 full of grease.

NOTE – The grease reservoir in the bracket of frames CD580 through CD685 is located behind the grease metering plate.

BRUSHES

WARNING: HIGH VOLTAGE AND ROTATING MACHINERY CAN CAUSE SERIOUS OR FATAL INJURY. BRUSHES SHOULD NOT BE TOUCHED OR REPLACED WHILE THE MACHINE IS ENERGIZED OR ROTATING.

CAUTION: DIRECT-CURRENT MOTORS AND GENERATORS OPERATED FOR LONG PERIODS OF TIME AT LIGHT LOADS OR IN CONTAMINATED ATMOSPHERES MAY BE SUBJECT TO ABNORMAL BRUSH AND COMMUTATOR WEAR. THIS CAN RESULT IN THE NEED FOR EXCESSIVE MAINTENANCE. IF THE APPLICATION REQUIRES OPERATION UNDER THESE CONDITIONS, THE GENERAL ELECTRIC COMPANY WILL BE PLEASED TO SUGGEST A CHANGE IN BRUSH GRADE OR OTHER MEASURES TO MINIMIZE THE PROBLEM.

Brush pigtails are provided with wear indicator markers (1). When marker reaches the top of the brush-holder box, brush should be discarded. Continued use of worn-out brushes will result in damage to commutator and impaired performance.

BRUSH REMOVAL (See Figures 1 & 2)

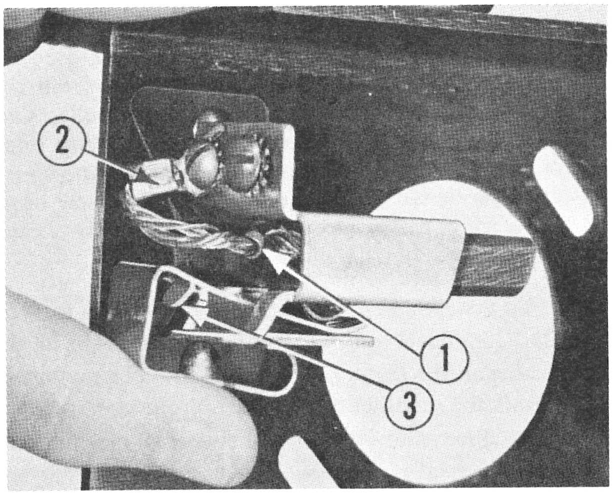

Fig. 1. Brush Removal FRAMES (182A - L186AT)

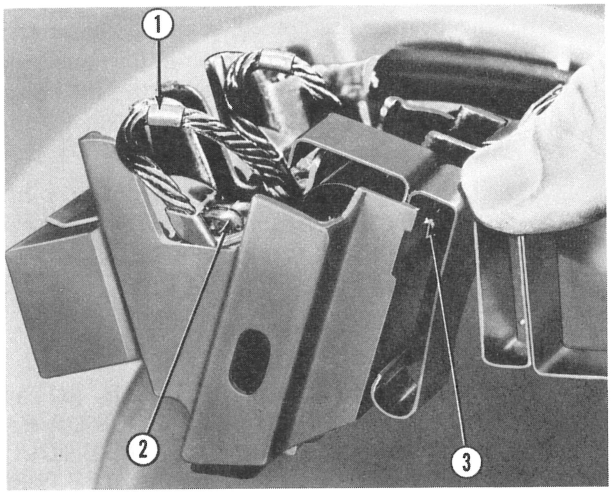

Fig. 2. Brush Removal FRAMES (215A - 685A)

WITH MACHINE STOPPED AND POWER OFF.

1. Unfasten pigtail (2).
2. Push spring in and toward opposite side of brush holder to disengage lock tab (3).
3. Lift spring out. Spring can either be completely removed from brush holder or left attached with outside bottom loop engaged in lock tab slot. Remove brush.

BRUSH INSTALLATION

1. Place brush in holder with bevel towards spring. Brushes should move freely in holder.
2. Push spring into position until lock tab engages slot and locks.
3. Connect pigtail.

Fit brush to commutator contour using strip of coarse sandpaper. DO NOT USE EMERY CLOTH. Keep the sand side turned to the brush face. After fitting brushes, clean the dust from the commutator, brush holder, and adjacent parts with a vacuum cleaner or other suitable means.

COMMUTATOR

Keep the commutator clean. Ordinarily, the commutator will require only occasional wiping with a piece of canvas or other nonlinting cloth. DO NOT USE LUBRICANT OR SOLVENT ON THE COMMUTATOR. Check the commutator for roughness while running by feeling the brushes with a fibre stick avoiding contact with live electrical or moving mechanical parts. Jumping brushes give advance warning of deterioration of commutator surface.

MECHANICAL

Check for condition of air filters and replace them if they are dirty. Check for unusual noises which were not present when the unit was originally installed. Check all electrical connections for tightness. Clean out any dirt from screens, louvers, etc. which would interfere with flow of cooling air.

LUBRICATION OF FLEXIBLE COUPLINGS

Flexible couplings are normally lubricated with a semi-fluid grease or an oil. The coupling manufacturers' instructions should be followed in choosing a lubricant and setting relubrication intervals. G-E ball-bearing grease D6A2C5 is a suitable lubricant for flexible couplings in most applications.

Flexible couplings which join a small machine to a large one may have two different size coupling halves joined by an adaptor plate. Couplings of this type have a separate lubricant supply for each half, so that both halves must be lubricated separately.

CLEANING OF WINDINGS

When harmful dirt accumulations are present, a variety of cleaning techniques are available. The one selected for a particular machine will depend on:

1. The extent of the cleaning operation to be undertaken
2. The particular machine involved
3. The type of dirt to be removed

FIELD SERVICE CLEANING (ASSEMBLED MACHINES)

DRY DUSTS

Dry dirt, dust, or carbon should first be vacuumed –

without disturbing adjacent areas or redistributing the contamination. Use a small nozzle or tube connected to the vacuum cleaner to enter into narrow openings, as between commutator risers. A soft brush on the vacuum nozzle will loosen and allow removal of dirt more firmly attached.

After the initial cleaning with vacuum, high-velocity air may be used to remove remaining dust and dirt.

WARNING: SAFETY GLASSES AND/OR OTHER PROTECTIVE EQUIPMENT SHOULD BE USED TO PREVENT POSSIBLE EYE INJURY.

Great clouds of dust may fill the air during this operation so, where possible, operate the machine at low speed to permit maximum dust removal. Also, continue vacuum cleaning to prevent contamination of the machine or adjacent equipment. Compressed air is to be clean and free from oil and water.

OILY DIRT

The presence of oil makes thorough, effective cleaning of machines in service virtually impossible, and Service Shop conditioning is recommended. Oil on a surface forms a "flypaper" which attracts and holds firmly any entrained dust. Neither suction nor compressed air is effective; consequently, only accessible areas may be cleaned. First, remove as much of the dirt as possible by wiping with clean, dry rags. For areas not readily accessible, a "shoe-shine" technique may be used. A clean rag is drawn through an opening by means of a hooked wire. The rag is drawn alternately back and forth. This process is continued until a clean cloth thus applied stays clean. The cloths should be changed frequently in any wiping operation; otherwise, the dirt or contamination picked up by the cloth may simply be transferred to another, perhaps previously uncontaminated, area.

To simplify removal of oily dirt, solvents are commonly prescribed. No liquid solvent as such is to be applied to any d-c machine, solvent application should be by a wiping rag barely moistened (not wet). Where dirt is heavy, repeated wipings may be required. Liquid solvent can carry conducting contaminants (metal dust, carbon, etc.) deep into hidden but critical areas to produce shorts and grounds, thus causing machine failure. Without special testing equipment such as the "armature surgetester," weakness that could result in shorts in the armature cannot be exposed. Grounding weakness may be studied with the "megger," but even here acceptability of the test is questionable, because the megger does not develop enough electrical energy to expose all of the weak grounding paths.

WARNING: SOLVENTS MAY BE TOXIC OR FLAMMABLE. ADEQUATE VENTILATION MUST BE PROVIDED TO MINIMIZE FIRE HAZARDS AND HEALTH HAZARDS CAUSED BY THE USE OF SOLVENTS FOR CLEANING PURPOSES.

WARNING: HIGH VOLTAGES. ELECTRIC SHOCK CAN CAUSE SERIOUS OR FATAL INJURY.

ELECTRICAL CIRCUITS MUST BE DE-ENERGIZED PRIOR TO CLEANING OR OTHER MAINTENANCE ACTIVITIES...GROUND ELECTRICAL CIRCUITS PRIOR TO CLEANING OR MAINTENANCE TO DISCHARGE CAPACITORS.

FREON TF (E. I. Dupont Co.) is the recommended solvent for cleaning because it is nonflammable, has good solvency for grease and oil, is considered safe with most varnishes and insulations, and has a low order of toxicity. Inhibited Methyl Chloroform is also acceptable. Carbon Tetrachloride is effective and nonflammable, but it is very toxic in confined spaces with repeated usage and is therefore not recommended. Toluene and Zylene and Stoddard Solvent (hydrocarbon solvents) possess good solvency, but are not recommended since they are flammable and attack varnishes quite readily. Steam cleaning is not recommended because, as with liquid solvents, conducting contaminants may be carried deep into inaccessible areas resulting in shorts and grounds.

CAUTION: CARBON BRUSH PERFORMANCE MAY BE RUINED BY ABSORBED SOLVENTS – REMOVE BRUSHES PRIOR TO SOLVENT WIPING.

SERVICE SHOP CLEANING (DISASSEMBLED MACHINES)

The usual Service Shop practice calls for an initial insulation resistance reading to be taken on each machine component. Low readings would be expected with badly contaminated machines, but failure would indicate electrical damage calling for repair, not just cleaning.

STEAM CLEANING

The steam jenny which sprays a high-velocity jet of steam and water containing a mild detergent is normally effective in cleaning windings. This is followed by multiple sprays of steam without detergent for rinsing. After drying the equipment, insulation resistance readings should be taken to determine the adequacy of the operation. Revarnish treatment is recommended to restore a protective-coating to the part.

SOLVENT CLEANING

In cases where dirt incrustations are not removable by steam cleaning and electrical circuit insulation is not restored, solvent cleaning is employed.

Actual immersion in Trechlorethane or Perchlorethylene with air agitation or suspension of the part in a vapor degreaser will soften dirt accumulations, permitting compressed air removal. Repeated cleanings in this manner may restore the insulated circuits. Hydrocarbon solvent cleaning by spraying or submerging is finally applied as a last resort. However, an appreciable percentage of complex structures (such as the armature) may never recover with submerged solvent cleaning, because conducting contaminants become trapped in critical fissures.

Where electrical circuit insulation is restored by submerged solvent cleaning, revarnish treatment is required.

CAUTION: DO NOT CLEAN THE COMMUTATOR BY SUBMERGING IT IN THE SOLVENT. CONDUCTING CONTAMINANTS MAY BE CARRIED INTO INACCESSIBLE, BUT CRITICAL, AREAS (SUCH AS BETWEEN THE CONE AND THE COOPER SEGMENTS OR IN GLASS-BOUND COMMUTATORS BETWEEN THE GLASS BAND AND THE COPPER).

OTHER CLEANING METHODS

Ground-up corn cobs, peanut husks and the like have been employed for mild abrasive-type cleaning of contaminated electrical components. Where visual contamination is removable in this manner, its use is highly recommended. Abrasive cleaning of complicated structures is inadequate because hidden areas remain contaminated.

DRYING OF WINDINGS

Drying of machines is most effectively done by the application of heat. The windings and insulation should be heated so that their temperature does not exceed 125 C at any location. (Do not make local hot spots.) The machine's own frame and the addition of some covers usually will make an effective enclosure to contain the heat, if an oven cannot be used. Some flow of air is desirable to allow moisture to be carried away. Methods of generating heat include: blowing hot air through the machine, heating with heat lamps, passing current through the main-field-coil windings and so on.

If temperatures as high as 125 C can be attained, they should be limited to 6 or 8 hours duration. Lower temperatures will cause correspondingly longer drying times.

RENEWAL PARTS

Use only genuine G.E. renewal parts. When ordering, specify model number and serial number of motor. (Complete nameplate data is desirable.) Specify quantity and describe part with the help of the information shown on Figures 3 and 4.

RENEWAL PARTS

1	Coil, Main and Pole
2	Conduit Box Cover
3	Coil, Comm and Pole
4	Armature
*5	Bracket, Bearing
*6	Bearing Ball, Antifriction
7	Fan, Armature
8	Yoke and Brushholder Assembly
10	Brush, Carbon
11	Spring, Brushholder
13	Cover, Hand Hole
15	Monogram
*	Specify whether Drive End or Front End

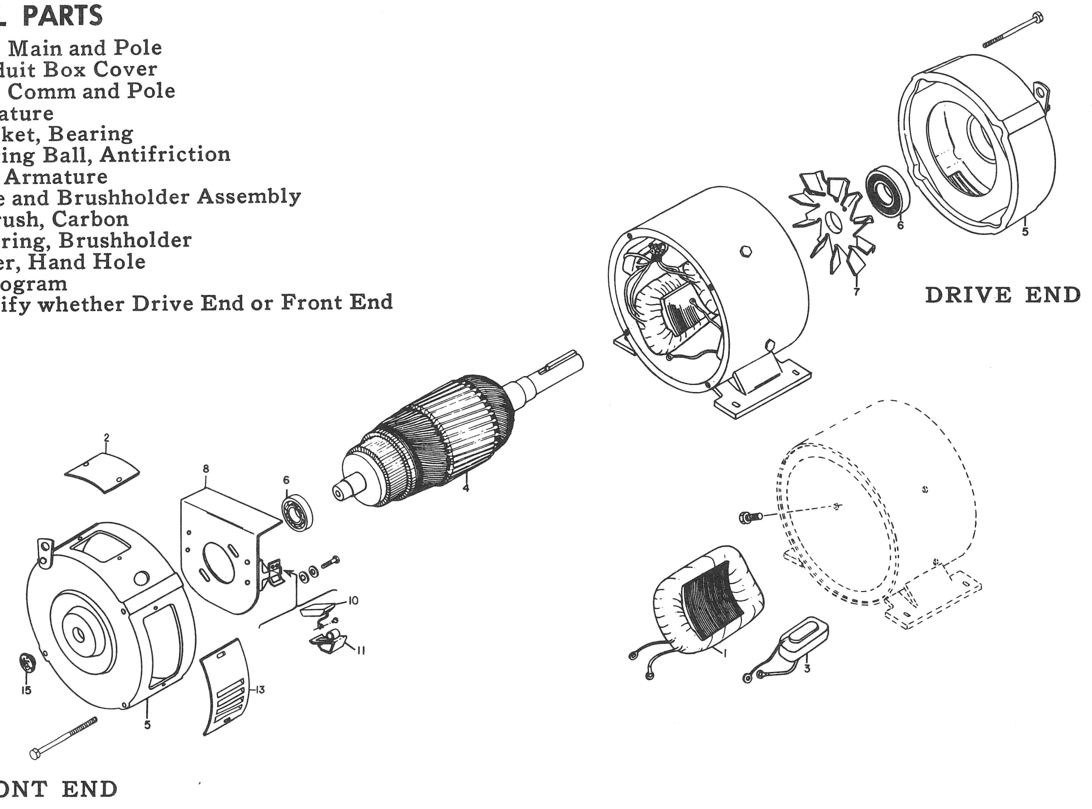

Fig. 3. Typical Direct Current Motor or Generator, Type CD, Frames 182AT to L186AT

SPARE PARTS

As insurance against costly downtime, it is strongly recommended that spare parts be kept on hand in accordance with the chart (Table IV) below.

TABLE IV RECOMMENDED SPARE PARTS

DESCRIPTION	NUMBER OF DUPLICATE MOTORS IN SERVICE				
	1	2-4	5-10	10-20	More than 20
WITH OR WITHOUT ELECTRICAL SHOP FACILITIES					
Complete Machine	...	...	...	1	2
Drive End Ball Bearing	1	1	1	2	3
Front End Ball Bearing	1	1	1	2	3
Brushes (Sets)	2	4	6	8	10
Brush holders (Sets)	...	1/2	1/2	1	1
Brush holder Springs (Sets)	1/2	1	1	2	2
Main Field Coil and Pole	...	1	1	2	3
Commutating Field Coil and Pole	...	1	1	2	3
Armature Complete*	...	1	1	2	2
Blower vent. motors					
Blower motors	...	1	1	2	2
Filters	2	4	6	8	10
WITH ELECTRICAL SHOP FACILITIES					
Shaft**	...	...	...	1	1
Armature Rewinding Supplies	...	1	1	2	3

* If shop facilities are available the quantity of armatures may be reducted by stocking the armature parts listed in the second group.

** Shaft not replaceable in diameters 250 and smaller.

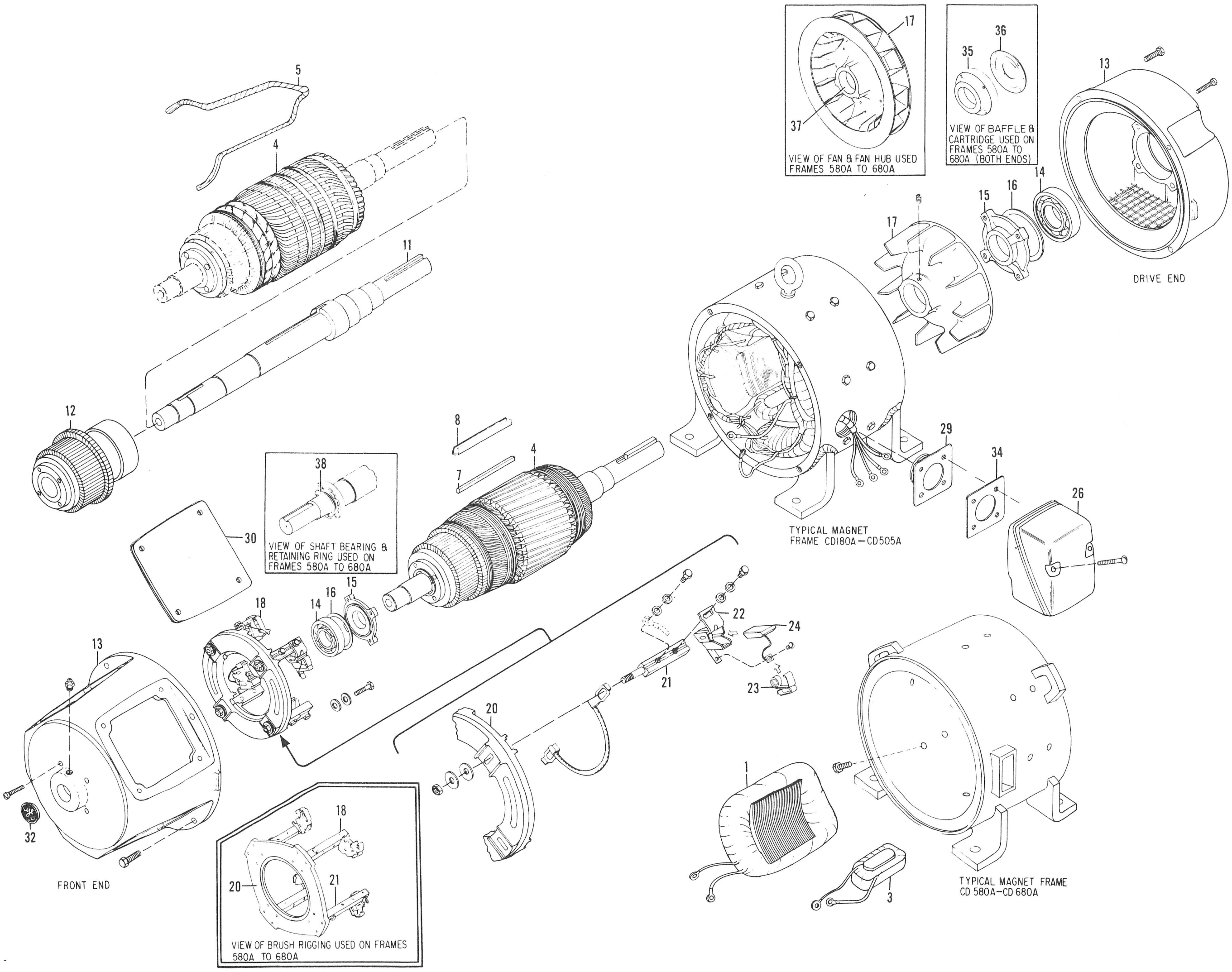
5
4
11
12
17
37
VIEW OF FAN & FAN HUB USED FRAMES 580A TO 680A
36
35
VIEW OF BAFFLE & CARTRIDGE USED ON FRAMES 580A TO 680A (BOTH ENDS)
13
14
15
16
17
DRIVE END
29
34
26
TYPICAL MAGNET FRAME CD180A—CD505A
8
7
4
38
VIEW OF SHAFT BEARING & RETAINING RING USED ON FRAMES 580A TO 680A
30
15
16
14
18
13
22
24
21
23
20
32
FRONT END
18
20
21
VIEW OF BRUSH RIGGING USED ON FRAMES 580A TO 680A
1
3
TYPICAL MAGNET FRAME CD 580A—CD 680A

Fig. 4. Typical Direct Current Motor or Generator, Type CD, Frames 215A to L685A.

Ref. No.	Description
1	Coil, main and pole
3	Coil, comm and pole
4	Armature
5	Coil, armature
7	Wedge, slot (through CD250A)
8	Strip, slot insulation
11	Shaft, armature (not available for frame 256 and smaller)
12	Commutator
13	*Bracket, bearing
14	*Bearing, ball, antifriction
15	*Cap, bearing
16	*Gasket, bearing cap
17	Fan, armature

Ref. No.	Description
18	Rigging, brush
20	Yoke, brush holder
21	Stud, brush holder
22	Brush holder (with pressure spring)
23	Spring, brush holder
24	Brush, carbon
26	Conduit box
29	Adapter, conduit box (not used on CD580A & CD680A)
30	Cover, hand hole
32	Monogram (not used on CD580A and CD680A)
34	Gasket, adapter, conduit box
35	*Cartridge, bearing
36	*Baffle, metering plate
37	Hub, fan
38	*Ring, retaining

*Specify whether for drive end or front end

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